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CLEANING, STORAGE, AND UTILIZATION OF USSR COALS SUITABLE FOR COKING

COAL CLEANING PROVIDES MORE RAW MATERIAL FOR COKING -- Moscow, Ugol', No 6, Jun 52

In the past 5 years coke by-products plants in the southern part of the USSR have achieved great success in extending supplies of coal suitable for coking. To this end the composition of coal charges has been radically changed. In 1933, the charges contained an average of 0.1 percent of gas coal; in 1940, 7.5 percent; and in 1951, 15.1 percent. During 1951, lean coal was introduced into the charge in the Novo-Makeyevka, Smolyaninovskiy, Mushketovskiy, Kramatorsk, and Khanzhenkovskiy plants.

The Main Administration of Coke, the South Office of the Main Administration of Coke, and scientific institutions of the USSR have cooperated with the coke by-products plants in an effort to draw upon new coals for coking, taking into consideration the correct composition of the charge and the continual improvement in the quality of the coke both in chemical composition and in mechanical properties. Experiments have indicated that it is possible to increase the proportion of gas coal used in a coking charge and to utilize lean coal with a low sulfur content (less than 1.5 percent) and long-flame coal with a medium sulfur content (less than 2.5 percent). At present, large amounts of coal which would be valuable for coking are not being sent to coal-cleaning plants simply because they are difficult to clean. Examples of this are coal from Vasil'yevskaya Mine No 4 and Vasil'yevskaya Mine No 6 of the Bogurayevugol' Trust, Kapital'naya Nol'naya Mine of the Sovetskugol' Trust, Severo-Gundorovskaya Mine of the Rostovugol' Combine, and from Mine No 18 of the Krasnodonugol' Trust.

Coals from another large group of mines have properties which would make them suitable for coking but not only is their ash content high but they also contain up to 4-5 percent of sulfur. Such coals can be used for coking only if given a preliminary cleaning to remove the ash and the sulfur. This will make it possible to eliminate the harmful activity of the mineral kernels on the mechanical properties of the blast furnace coke and will contribute towards the maintenance of the former level of productivity of the blast furnaces and the former level of consumption of coke and flux per ton of pig iron.

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Coal ash is of two different types: (1) free or external ash which has come from the roof, floor, or layers of rock, and (2) ash which is closely bound up in the organic mass of the coal. The former type is more harmful since it forms the nucleus for cracks in the coke. However, this type of ash is easily removed by mechanical cleaning and there is no need of deep cleaning.

If the sulfur content has to be reduced simultaneously with the ash, then deep cleaning is required. /This coal-cleaning method depends on the fact that the constituents of coal have different specific gravities. A solution with an intermediate specific gravity is selected and the coal is immersed in it; whereupon, the heavier substances sink and the lighter substances rise to the surface./ Experiments in cleaning were conducted at the following specific gravities: 1.8, 1.6, 1.5, 1.4, and 1.3. It was discovered that the amount of sulfur eliminated increased with each decrease in the specific gravity. At the same time, the amount of concentrate to be used for coking purposes decreased. However, this was compensated for by an increase in the amount of residue that could be used for fuel purposes.

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The coal selected for the experiments had a sulfur content ranging from 4 to 6.68 percent. In all cases, it was either Type K or Type PZh coal. Type K coal came from the following mines: Mine No 178, Ovcharnyy seam; Stal' Mine No 5, Bulatovskiy seam; and Mine No 68, Solenyy seam. Type PZh coal came from Nikitovka Mine No 6-7, Kirpichevka seam; Gorlovka Mine No 40, Yuzhnaya Arshinka seam; and Mine No 134, V. Kamenskiy seam. -- Ya. M. Cbukhovskiy

USE OF COKE PRODUCED FROM KIZEL COAL -- Moscow, Ugol', No 12, Dec 52

Coal from the Kizel basin is characterized by its valuable coking properties and by a high yield of gas and chemical by-products evolved in the process of coking. However, the use of Kizel coal for coking requires preliminary cleaning. From run-of-the mine coal, with an ash content of 21.5 percent and a sulfur content of 5.8 percent, 62-71 percent of concentrate can be obtained with an ash content of 10-11 percent and a sulfur content of 3.2-3.3 percent. The phosphorus content of run-of-the mine coal is slight, ranging from 0.007-0.012 percent. It is bound up with the mineral part of the coal and separates out completely during the cleaning process although traces of it are usually detected in the concentrate.

Nonferrous metallurgy and the chemical industry are the chief consumers of Kizel coal. Plans are under way to develop the cleaning of this coal and, when that has been done, the coke by-products industry of the Urals will undoubtedly become its largest comsumer. In nonferrous metallurgy, coke is used mainly for water-jacket smelting of nickel and copper.

This type of coke may differ from blast furnace coke in the following respects:

1. In water-jacket smelting a sulfurization of the ores takes place and consequently the restriction in the sulfur content of the coke drops. In addition to the sulfur in the coke, from 1.2 to 1.8 percent of sulfur is introduced in the charge (in proportion to the ore) in the form of sulfur-containing fluxes (pyrite, gypsum). For the complete elimination of sulfur-containing fluxes the sulfur content in the coke can be brought to 6.7 percent.

2. In water-jacket smelting less consumption of coke is required in comparison with other raw materials than in blast furnace smelting.

3. The toughness of the coke may be lower since the water-jacket furnace is several times smaller in dimensions than the blast furnace.

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4. The temperature for the process of water-jacket smelting is considerably lower than for the blast furnace method and this permits the utilization of less tough coke.

5. Since less coke is consumed in water-jacket smelting there is less need of restricting the ash content of the coke than in the case of a blast furnace.

With the normal operation of the furnaces on Gubakhinskiy coke /from Gubakhinskiy Plant located in Molotovskaya Oblast/ the content of monoxide in the gas yield may be lowered to 2-3 percent and, when operating on Kemerovo and Donets coke, it may be reduced to 5-6 percent. Thus the Gubakhinskiy coke burns with better utilizaton of its calorific value because of its greater firmness and smaller number of pores. This explains the fact that after the conversion of the water-jacket furnaces to operation on Gubakhinskiy coke with its higher ash content, the consumption of it (in percent of the charge) did not increase in comparison with the consumption of Kemerovo or Donets coke with their lower ash content. Gubakhinskiy coke contains a rather high amount of sulfur, up to 3 percent, which decreases the consumption of sulfur-containing flux used in smelting oxidized nickel ores. This permits a reduction of almost 50 percent in the consumption of gypsum (from 10-11 to 6-7 percent of the weight of the raw ore).

Ural copper plant coke consumption for smelting copper ranges from 2.8 to 5.6 percent of the weight of the charge. The chief qualitative requirements for coke used in the copper-smelting industry are that it should be well fused and lacking in small particles. The latter reduce the gas permeability and create unnecessary resistance for gases passing through the charge shaft. The ash content of coke going to Ural copper plants is, at present, 16-17 percent.

Although Kizel coal cannot make up a 100-percent charge for a blast furnace because of its high content of ash and sulfur, experiments conducted in the Magnitogorsk Metallurgical Combine have indicated that up to 50 percent of Kizel coal may be combined with other coals containing less ash and sulfur to make a satisfactory blast furnace charge -- O. F. Vaysberg

EXPERIMENTS IN STORAGE OF COAL FOR COKING -- Moscow, Za Economiyu Topliva, No 6, Jun 52

Inefficient storage of coal brings about considerable losses in its coking properties and, as a result, the quality of the metallurgical coke obtained from such coal is impaired. In this connection, it is seldom taken into account that a change in the coking properties of the coal may occur before changes in its other properties are observed.

For economy and preservation of the quality of coal it is necessary to establish the best time limits for storing coal of different types. To this end, industrial experiments were carried out in eastern coke by-products plants using types of Kuznetsk and Karaganda coal suitable for coking.

A study was made of the influence of the length of storage on the coking properties of coal in the mechanized coal storage area of the Magnitogorsk Metallurgical Plant and the ground storage areas of the Chelyabinsk and Nizhne-Tagil plants

In setting up the experimental piles, areas were selected which were suitable for dumping and for preserving the piles in their entirety. Each pile in the mechanized storage area contained 8,000-10,000 tons and each pile in the ground storage area contained 4,000-6,000 tons. In both cases the piles were

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60-100 meters long. Piles in the mechanized storage area were 22 meters wide and 9-10 meters high while those in the ground storage areas were 10 meters wide and 4-6 meters high.

Observations indicated that the average diameter of the coal lumps decreased during storage and changes in the elementary composition of the coal were observed, for most types of coal only after lengthy storage. These changes were slight except for G2 and KZh types of coal, as is indicated in the following table:

Name of Mine and Coal	Storage Period (days)	Components of Fuel Mass C (%)	H (%)	O (%)
Pionerka, G2	0	84.93	5.70	5.47
	45	84.55	5.78	5.72
Osinovskiy, Zh1	0	88.38	5.51	2.89
	75	88.35	5.53	2.87
	150	88.58	5.48	2.65
	190	88.52	5.40	2.66
Baydayevskiy, Zh2	0	86.03	5.68	5.42
	45	86.10	5.30	5.30
	90	85.95	5.54	5.00
	170	85.08	5.61	5.67
Krasnogorskaya, KZh	0	89.03	5.30	2.77
	45	89.12	5.06	3.27
	75	88.52	5.29	3.75
	105	88.57	5.18	3.87
	150	88.64	5.21	3.58
	200	88.38	5.06	3.64
Imeni Molotov, K	0	89.64	4.88	2.56
	45	89.73	5.07	2.46
	95	89.62	4.87	2.59
	200	88.77	4.96	2.66
Uncleaned Karaganda coal	0	87.20	5.39	5.12
	35	87.22	5.27	5.12
	50	87.53	5.25	5.43

The coking properties of coal are the least stable of its characteristics during storage and loss of them is noticed much earlier than loss of other qualitative characteristics of coal. Experiments were conducted to determine how long coal could be kept in storage without deterioration of its coking properties using K coal from the Mines imeni Molotov and Stalin, K2 coal from Kiselevskiy Mine, KZh coal from Krasnogorskaya Mine, Zh1 coal from Osinovskiy Mine, Zh2 coal from Baydayevskiy Mine, G2 coal from Pionerka Mine, and both cleaned and uncleaned Karaganda coal. As a result of these experiments, the following time limits have been set up as most favorable for storage of Kuznetsk and Karaganda coal: G2 coal, not more than $1\frac{1}{2}$ months; Zh1 coal, not more than 2 months; Zh2 coal, not more than 2 months, KZh coal, not more than 2 months; K coal not more than $1\frac{1}{2}$ months; K2 coal, not more than $1\frac{1}{2}$ months; cleaned Karaganda coal, not more than one month; uncleaned Karaganda coal, not more than one month. -- V.V. Bogoyavlenskiy, M. G. Fel'dbrin, V. L. Krol', and Ye. A. Khersonskaya

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